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tively small and has not been found to contain pollen grains. The megaspore membrane is distinct, but structureless, and no traces of endosperm or archegonia were found.

The second part of the paper will be devoted to a discussion of the general bearing of the investigation and the probable affinities of the seed. It is to be regretted that in such a paper the citation of literature is not more specific. Reference merely to volume numbers puts needless work upon those who wish to consult the literature.—J. M. C.

Dorsiventrality in mosses.—NĚMEC has continued his study of dorsiventrality induced by light, finding additional species[14] in which this character can be altered. The tenacity with which dorsiventrality is retained under changed illumination differs widely. Thus in *Anomodon viticulosus* every flank in turn, as more strongly illuminated, may become the dorsal side. In Neckera and Homalia, on the contrary, only the dorsal and ventral sides could be made to exchange relations. Ageotropic species are usually strongly diaheliotropic (but may become positively clinoheliotropic), turning the dorsal side toward light. Geotropic species are hindered from acquiring a diaheliotropic position, especially if they must curve nearly to the horizontal. The species whose dorsiventrality is not reversible sometimes do not attain completely the diaheliotropic position if much bending is required. Such incomplete reactions are still more common among leafy Jungermanniaceae.

In a later paper on the same lines[15] NĚMEC deals especially with *Fissidens* spp., and *Dicranum scoparium*. In Fissidens the dorsiventrality (morphological as well as physiological) can be abrogated and recalled at will. The stems are also diaheliotropic and geotropic. In *Dicranum scoparium* the lateral curvature of the leaves is a heliotropic response which is induced very early and persists for a considerable time even in darkness, but finally disappears, returning again with one-sided illumination. The complicated interrelations of geotropism and heliotropic dorsiventrality are worked out in detail.—C. R. B.

Galvanotropism of roots.—A paper on this subject, published in September 1904 by Dr. AMOS PLOWMAN,[16] has come to our attention since writing the notice of the papers by SCHELLENBERG and GASSNER.[17] The methods used and the conclusions reached are anticipatory, in large measure, of those of GASSNER. PLOWMAN used carbon electrodes and states the strength of currents used in terms of current density, those mentioned lying mostly between 0.1 and 1.5 milliamperes per cm²-sec. He finds the positive curvature constant and shows clearly that it is due to injury of the cells on the positive side. He does not find the negative curvature constant in any case, but observes that the positive curvature (which he calls normal) may be produced, even when the negative appears, by varying the strength and time of action of the current. This GASSNER confirmed, but he paid more attention to the negative curvature as the initial effect of very weak currents, and lays stress on it in identifying galvanotropism with traumatropism as an irritable phenomenon.

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[14] NĚMEC, B., Die Induktion der Dorsiventralität bei einigen Moosen. II. Bull. Int. Acad. Sci. Boheme **11**: (1–7). 1906.

[15] NĚMEC, B., Die Symmetrieverhältnisse und Wachstumsrichtungen einiger Laubmoose. Jahrb. Wiss. **43**:501–579. *figs. 33.* 1906.

[16] PLOWMAN, A., Electrotropism of roots. Am. Jour. Sci. IV. **18**:228–236. *pls. 9, 10.* 1904. Also earlier reports *ibid.* **14**:131. 1902, and **15**: 94–104. 1903.

[17] BOT. GAZETTE **43**:218. 1907.

PLOWMAN ascribes the injury causing positive curvatures to positive electrons bombarding the side of root turned toward the anode (wherefore he prefers *electrotropism*). He specifically denies the influence of products of electrolysis. Negative electrons he finds innocuous and perhaps even stimulative. Thus his facts are mainly corroborated by GASSNER, but the two interpretations are quite different. GASSNER also seems to have entirely overlooked PLOWMAN's papers.—C. R. B.

Morphogenesis in Ceratophyllum.—A recent publication by the Carnegie Institution,[18] under the authorship of Dr. PEARL and assistants, proves to be a contribution of unusual merit because of the masterly way in which the biometrical method has been applied to one of the most important but neglected problems of biology. Two laws of growth in Ceratophyllum have been formulated on the basis of convincing evidence. The first law is: "The mean number of leaves per whorl increases with each successive whorl, and in such a way that not only does the absolute increment in each leaf-number diminish, but also the rate of increase diminishes as the ordinal number of the whorl, measured from a fixed point, increases." The second law is: "As whorls are successively produced by a growing bud, they are formed with ever-increasing constancy to their type, the ultimate limit towards which the process is tending being absolute constancy." The significance of these laws and the field for physiological study suggested by them is far too great to be elaborated here and reference to the original is urged. The paper shows a clear scientific discernment and is a model of composition. It may safely be said that the Carnegie Institution has not wasted any money on this minor grant. The value of such a contribution as compared with its insignificant cost goes far toward compensating for the cost of other small grants which have proved less fruitful.—RAYMOND H. POND.

Relation of saprophytic fungi to the substratum.—Two papers have appeared dealing with the relation of some saprophytic fungi to their substratum. The first of these, by KRATZ,[19] deals with pyrenomycetes growing on dead stems of herbaceous plants and on leaves. It consists mostly of brief categorical descrip-

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[18] PEARL, RAYMOND, with the assistance of OLIVE M. PEPPER and FLORENCE J. HAGLE, Variation and differentiation in Ceratophyllum. Pub. Carnegie Institution of Washington no. —. pp. 136. 1907.

[19] KRANTZ, CARL VON, Ueber die Beziehungen der Mycelien einiger saprophytischer Pyrenomyceten zu ihrem Substrat. Hedwigia **46**:1–24. *figs. 8.* 1906.